REPTILES FROM LATE PLEISTOCENE DEPOSITS ON KANGAROO ISLAND, SOUTH AUSTRALIA

by MEREDITH J. SMITH*

Summary

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Trachydosaurus rugosus and *Tiliqua nigrolutea* bones were abundant in a deposit laid down about 16 000-10 000 years BP, in Seton Rock Shelter near the south coast of Kangaroo Island. These two species do not occur naturally on Kangaroo Island now. Much less abundant in the deposit are bones of two unidentified elapid snakes and *Varanus* sp., *Egernia* sp. *cf. E. whitii, Amphibolurus* sp. *cf. A. decresii* and an unidentified species of the *A. barbatus* species group. No species of *A. barbatus* group lives on the island at present. The possible causes of the extinction of the lizards are discussed.

KEY WORDS: Reptilia, Pleistocene, Australia, Kangaroo Island.

Introduction

The reptile fauna of Kangaroo Island, South Australia, is poor in species compared with nearby mainland areas offering an equal diversity of habitats (Houston & Tyler 1979). Only 20 reptile speeies are natural inhabitants, the fauna comprising five species of elapids, ten scincids, two gekkonids and a single pygopodid, agamid and varanid (Houston & Tyler 1979). The historical baekground of this impoverished fauna might perhaps be indicated in fossil deposits laid down before the island was last cut off from the mainland.

Kangaroo Island is about 145 km long and has a land area of 4400 km^2. Depths read from Admiralty Charts and a derived glacioeustatic curve allowed Hope *et al.* (1977) to infer that Kangaroo Island was continuous with the South Australian mainland during the late Pleistocene. Backstairs Passage, the strait between Kangaroo Island and Fleurieu Peninsula, would have opened between 10 500 and 9300 years BP and the slightly shallower Investigator Strait between Kangaroo Island and Yorke Peninsula would have formed soon after (9900–8800 years BP, Hope *et al.* 1977).

In the Seton Rock Shelter on the south coast of Kangaroo Island a stratified, bone-bearing deposit was found that had been laid down before the straits formed. Two radiocarbon dates are available, both from charcoal (Hope *et al.* 1977): 10 940 ± 160 years BP from the upper cultural horizon and 16 110 ± 100 BP from the lower cultural horizon.

The fauna of this deposit has been listed and the implieations of the differences between Late Pleistocene and present day fauna's discussed, mainly with respeet to mammals (Hope *et al.* 1977). In the present paper the reptile fossils from this deposit are described and details are given of their identification.

Methods

Seton Rock Shelter is in the northern face of a limestone ridge in undulating country supporting mallee scrub. The deposit was excavated by R. J. Lampert. Two adjacent pits, each 1 m^2, were exeavated in spits that varied from 5–10 cm in depth, depending on the stratum. The excavated material was hand-sorted except for a few samples which were sieved (Hope *et al.* 1977).

The spits were grouped into four horizons in descending sequence: (1) an upper cultural horizon; (2) a noncultural predator horizon; (3) a lower cultural horizon; (4) a lower noncultural horizon (Hope *et al.* 1977).

Results

Reptile bones were abundant at all levels except the upper ⅔ of the upper cultural level (Table 1). In most units the most abundant reptile, *Tiliqua nigrolutea*, was represented by a far greater minimum number of speeimens than the most abundant mammal. All the bones were damaged and, in fact, very few fragments exceeded 20 mm length. All the

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TABLE 1. *Minimum numbers of reptiles and minimum number of all mammals from each horizon of Seton Rock Shelter.*

	Upper cultural	Upper noncultural	Lower cultural	Lower noncultural	Total
Trachydosaurus rugosus	3	37	5	13	58
Tiliqua nigrolutea	12	235	21	69	337
cf. Egernia whitii	1	25	2	5	33
Varanus sp.	—	1	—	—	1
Amphibolurus sp.	3	14	1	12	30
Elapid snake	1	2	1	1	5
	(18)*	(234)	(19)	(101)	(372)
Total mammals[a]	127	542	62	178	909

[a] Data from Hope *et al.* 1977, Table 1.
* Total number of dorsal vertebrae in parentheses.

reptile bones are now lodged in the palaeontological collection of the South Australian Museum.

SCINCIDAE

Trachydosaurus rugosus Gray

Material: Osteoderms (480); quadrates (25); parietals (16); frontals (22); articulars (13); dentaries (39 left (L), 35 right (R)); maxillae (42L, 39R); premaxillae (2L, 1R); tooth-bearing fragments (15); vertebrae—cervical (37), dorsal (105), sacral (4), pygal (3), caudal (10); humeri (44); femora (14), clavicle (1), ilia (2), angulars (3), basioccipital (1).

Registered examples of *T. rugosus*: P23303, a left dentary from the upper noncultural horizon and P23306, parietals from the lower noncultural horizon.

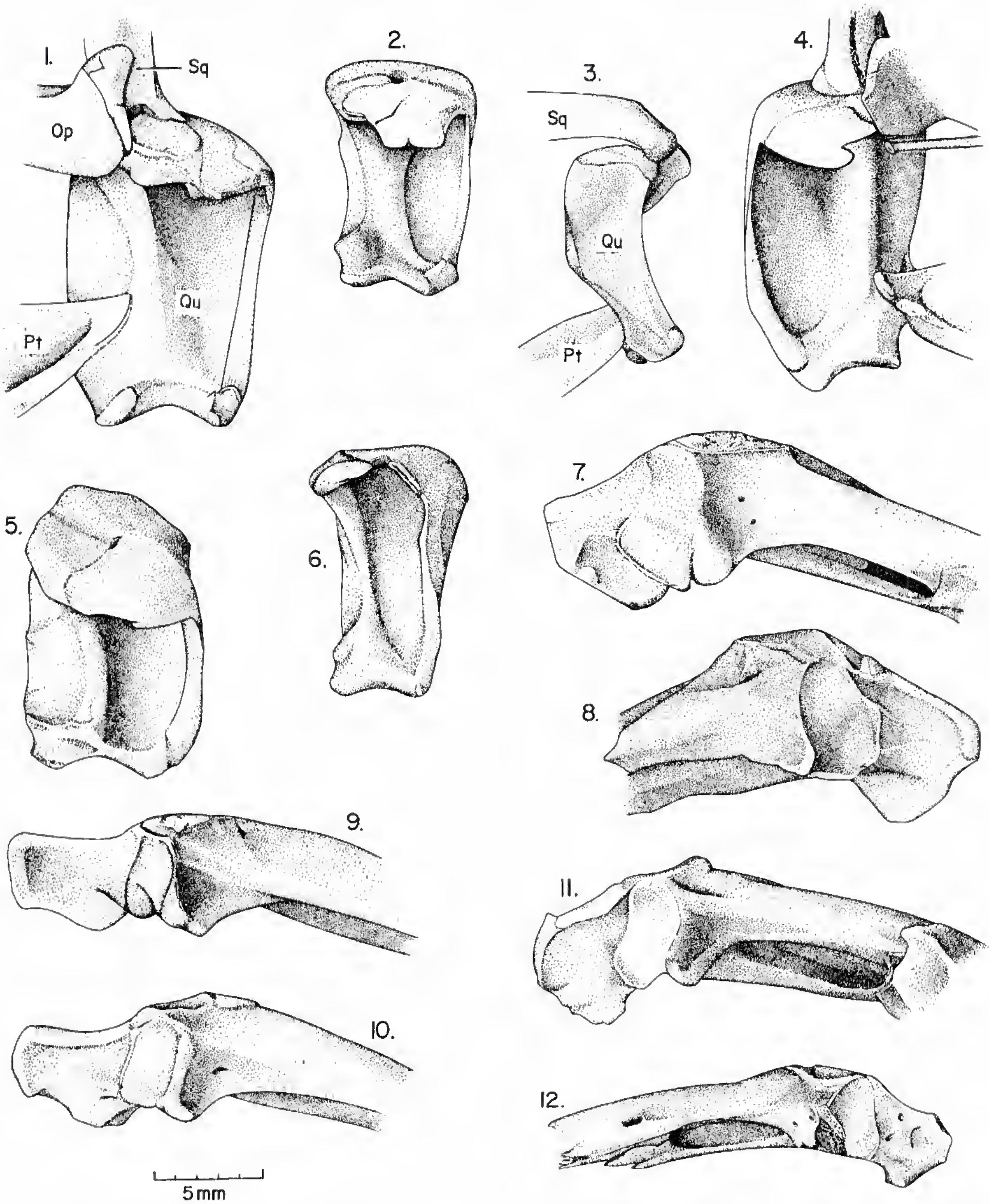
The more abundant bones listed above all show the specific characteristics of *T. rugosus* (Smith 1976). The quadrates and articulars are also distinctive. The quadrate (Figs 1, 5) is wider (W > 2/3 L) than in species of *Tiliqua* (W < 2/3 L) and this is mainly due to a wall of bone extending mesially from the quadrate's thickened strut between squamosal and articular facets. Hence, in *T. rugosus* the strut lies almost in the middle of the quadrate (as viewed from behind) but in species of *Tiliqua* (Figs 2-4) the strut lies nearer the inner edge of the quadrate. This is especially conspicuous in *T. nigrolutea* (Fig. 2) where the inner border of the quadrate is almost at the strut. In *T. scincoides* (Fig. 3) the squamosal articulation facet is at the inner posterodorsal corner. In *T. rugosus* and *T. occipitalis* the posterior process of the parietal does not reach the opisthotic, while in *T. nigrolutea* and *T. scincoides* the long parietal process is in contact with the opisthotic dorsal to the articulation of opisthotic and quadrate of each side of the skull. The opisthotic articulates with the squamosal in *T. rugosus*, *T. nigrolutea* and *T. occipitalis* whereas in *T. scincoides* the tiny supratemporal separates opisthotic and squamosal.

The retroarticular process of *T. rugosus* (Figs 7, 8) is inturned mesially and is shorter than wide, whereas in *T. scincoides* and *T. occipitalis* it is longer than wide (Figs 9, 10). In *T. nigrolutea* the retroarticular process is relatively wide as in *T. rugosus*, but it is only slightly inturned (Fig. 11). *T. occipitalis* differs from *T. scincoides* in having a distinct mesial process about halfway along the inner border of the retroarticular process (Figs 9, 10).

Tiliqua nigrolutea Gray

This species was abundant throughout the deposits, except for the four uppermost units. In one unit, the lower unit of the upper noncultural horizon, a minimum number of 112 *T. nigrolutea* were represented, while the total minimum number of mammals (marsupial and rodent) was only 203 (Table 1). Even at the lowest level, where bone was relatively sparse, a minimum of 14 *T. nigrolutea* were recovered compared with 42 mammals. Considering that an adult *T. nigrolutea* weighs over 200 g and that the three *Pseudomys* species that account for most of the mammals weigh 30-70 g the contribution of *T. nigrolutea* is significant in terms of bulk as well as of individuals.

Material: Quadrates (55); parietals (7); frontals (15); articulars (14); dentaries (327L, 269R); maxillae (213L, 206R); premaxillae (10L, 17R); other tooth-bearing fragments (175); vertebrae—cervical (91), dorsal (327),



Figs 1–12, 1–6 quadrates, 7–12 retroarticular processes. 1. *T. rugosus,* posterior view of right quadrate in position in skull, specimen from Cunnamulla, Qld. 2. *T. nigrolutea,* posterior view of isolated right quadrate, specimen from Mt Gambier, S.A. 3. *T. scincoides* lateral view of left quadrate in position in skull, specimen from Murray Bridge, S.A. 4. *T. occipitalis,* posterior view of left quadrate in position, locality of origin not known. 5. *T. rugosus,* P23304, right quadrate. 6. *T. nigrolutea,* P23308, right quadrate, posterior view. 7. *T. rugosus* left mandible, dorsal view, specimen from Cunnamulla, Qld. 8. *T. rugosus,* P 23305, right mandible, dorsal view. 9. *T. scincoides* left mandible, dorsal view, specimen from Armidale, N.S.W. 10. *T. occipitalis* left mandible, dorsal view, locality of origin not known. 11. *T. nigrolutea* left mandible, dorsal view, specimen from near Mt Gambier, S.A. 12. *T. nigrolutea,* P23309, right mandible, dorsal view.

op, opisthotic; pt, pterygoid; qu, quadrate; sq, squamosal.

sacral (6), pygal (6), caudal (65); humeri (99); femora (23); basioccipitals (2).
Registered examples of *T. nigrolutea*: P23307, a left dentary and P23310, parietals from the upper noncultural horizon.

The osteological differences between *T. nigrolutea* and *T. scincoides* are slight (Smith 1976) and specific determination can be made only on complete bones. The number of complete bones from Seton Rock Shelter is low, despite the abundance of material. However, wherever the diagnostic features are preserved they are those of *T. nigrolutea*, e.g. the retroarticular processes on the articulars are short and broad (Fig. 12); in the quadrates the strut lies close to the inner edge (Fig. 6); the dentaries are curved outwards; the neural spines are usually bifid. The only exceptions are five dorsal vertebrae from the upper noncultural horizon which have the neural spine undivided, though marked by a median groove.

Because only a small amount of the material can be specifically determined, the possibility cannot be excluded that *T. scincoides* is also represented.

Egernia sp. *cf. Egernia whitii* (Lacépède)

Material: Fragments of dentaries (26L, 22R); maxillae (5L, 5R); cervical vertebrae (1).
Registered example of *Egernia* sp.: P23312, a right dentary from the upper noncultural horizon.

The dentaries have a closed Meckelian groove as in species of *Egernia*, and they and the maxillae are consistent with *E. whitii* in size, shape and tooth-form. However the material may include some *E. multiscutata* Mitchell & Behrndt.

VARANIDAE

Varanus sp.

Material: Fragments of caudal vertebrae (5), distal end of humerus (1). Registered example of *Varanus* sp.: P23311, a caudal vertebra from the upper noncultural horizon.

This material is insufficient for specific diagnosis. *Varanus gouldii* (Gray) is abundant on Kangaroo Island at present.

AGAMIDAE

Amphibolurus spp.

Material: Fragments of parietals (1); dentaries (24L, 15R); maxillae (4L, 4R); other tooth-bearing fragments (30); vertebrae—dorsal (3), caudal (1).
Registered examples of *Amphibolurus* spp.: Larger species: P23314, a fragment of left dentary, with 3 teeth, from the upper cultural horizon. Smaller species: P23313, a left maxilla from the upper noncultural horizon.

Because size alone generally is not a reliable criterion for identifying reptile fragments the agamid specimens are lumped in Table 4 and in "Material" above.

Larger species *Amphibolurus* sp. cf. *A. barbatus* (Cuvier) and *cf. A. vitticeps* Ahl.

This species is represented only by a few tooth-bearing fragments, none of them found deeper than "level h" in the upper noncultural horizon. They conform in size and shape with *A. barbatus* and *A. vitticeps* and cannot be positively identified. The individual teeth are up to 1.6 mm long (measured along the jaw), and depth of the dentary is up to 4.4 mm. No agamid now living on Kangaroo Island attains this size.

Smaller species *Amphibolurus* sp. *cf. A. decresii* (Duméril & Bibron).

Dentary tooth rows of the smaller *Amphibolurus* species from Seton Rock Shelter are about 11 mm long and contain up to 16 teeth. They are comparable with those of *A. decresii* which lives on Kangaroo Island at present.

ELAPIDAE

Material: Vertebrae—dorsal (372), caudal (2).

Identification of elapid vertebrae depends on subtle differences in proportions of the centrum and shape of the neural spine, accessory processes and other processes (e.g. Smith 1975). Not one of the many vertebrae from Seton Rock Shelter was complete, and very few were sufficiently intact for the determination of even basic characters such as relative width or relative length of neural spine.

At least two species are present, one of which appears to be referable to a species of *Notechis*. *Notechis ater* and *Austrelaps superba* are found on Kangaroo Island at present.

Discussion

The very high incidence of reptile material is unusual in Late Pleistocene or Recent deposits in Australia. This difference may have arisen because the Seton Rock Shelter deposit accumulated largely from prey and carrion eaten there by Tasmanian Devils (*Sarcophilus harrisii*) (Hope *et al.* 1977), whereas in most other cave deposits much of the bone was deposited by roosting owls (e.g. Archer & Baynes 1972, Smith 1977). In the deposit in Devils Lair, Western Australia, which, despite the name of the cave, probably accumulated from several sources, the relative abundance of lizards fluctuates throughout the 35 000 year span of accumulation. Significantly, the proportion of lizards relative to mammals increased in terminal Pleistocene time to a peak in one particular layer in Devils Lair where a minimum of 80 lizards were found and a total minimum of 49 mammals. The proportion of lizards declined rapidly in the early Holocene. Although the lizards were not specifically identified, very small skinks were predominant (Balme *et al.* 1978). Lizards were present but did not dominate the fauna of several deposits which were thought to have originated almost entirely as the food remains of *Dasyurus viverrinus* (Wakefield 1960).

The Seton Rock Shelter fauna includes three species of lizard that do not now occur naturally on Kangaroo Island. *Tiliqua nigrolutea* was abundant on Kangaroo Island between 16 000-10 000 years BP; since then it has become extinct on Kangaroo Island. However it has survived on several Bass Strait islands, most of which were isolated by the rising sea level about 12 000-10 000 years ago (Rawlinson 1974) and all of which are smaller than Kangaroo Island. *Trachydosaurus rugosus* and also the larger agamid species died out on Kangaroo Island. In 1926, 100 individuals of *T. rugosus* were released near Rocky River homestead and specimens are seen occasionally in that area (Houston & Tyler 1979). Some individuals of *Tiliqua scincoides* were released at a later time (Houston & Tyler 1979).

In the search for a cause for these local extinctions several factors can be considered. Climate is one factor. *Tiliqua nigrolutea* is now confined to the cool temperate zone in southeastern New South Wales, southern Victoria, Bass Strait islands, Tasmania and southeastern South Australia where it does not occur further north or west than Mt Gambier (Rawlinson 1974). Such a distribution suggests that *T. nigrolutea* might be adversely affected by increasing aridity. On the other hand, the present distribution of *T. rugosus* extends into semi-arid areas (Cogger 1975) where the climate is far hotter and drier than on Kangaroo Island. For both species to have died out because of climatic change would have required a drastic climatic reversal in the Holocene.

Another factor that can be considered is habitat change occurring in the absence of marked climatic change. Considering the mammalian and avian faunal changes too Hope *et al.* (1977) hypothesized that most of the extinctions on the island could be attributed to an increase in dense scrub and reduction of open areas in response to increasing rainfall and reduction in burning after the disappearance of the Aboriginal population (Hope *et al.* 1977). *Trachydosaurus rugosus* and species of the *A. barbatus* group live in woodland and more open habitats (Cogger 1975, Houston 1978); reduction in open areas would be inimical to these species. However, the preferred habitat of *T. nigrolutea* includes not only woodland but also heath and dry sclerophyll forest, although it is most active in clearings surrounded by dense heath or arboreal vegetation (Rawlinson 1974).

A third factor might be the interaction with other animal species. The disappearance of the Aborigines may have allowed the population of *Varanus gouldii* to increase (Hope 1981). *Varanus gouldii* is represented by only six fragments in the material recovered from Seton Rock Shelter, yet it is now abundant (Houston & Tyler 1979). Lizards are eaten by *V. gouldii* (Houston 1978).

The contributions of the various factors to the extinction of the lizard species cannot be determined except very broadly. However the presence of *T. nigrolutea*, *T. rugosus* and the agamid species of the *A. barbatus* group shows that the impoverished reptile fauna of Kangaroo Island has resulted by attrition of a richer fauna.

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References

ARCHER, M. & BAYNES, A. (1972) Prehistoric mammal faunas from two small caves in the extreme southwest of Western Australia. *J. R. Soc. W. Aust.* **55**, 80-89.

BALME, J., MERRILEES, D., & PORTER, J. K. (1978) Late Quaternary remains, spanning about 30 000 years from excavations in Devil's Lair, Western Australia. *Ibid.* **61**, 33-65.

Cogger, H. G. (1975) Reptiles & Amphibians of Australia. Reed, Sydney.

Hope, J. (1981) A goanna in the works. *Australian Archaeology* **12**, 115-122.

Hope, J. H., Lampert, G. J., Edmondson, E., Smith, M. J., & Van Tets, G. F. (1977). Late Pleistocene faunal remains from Seton rock shelter, Kangaroo Island, South Australia. *J. Biogeog.* **4**, 363-385.

Houston, T. F. (1978) Dragon Lizards and Goannas of South Australia. South Australian Museum, Adelaide.

Houston, T. F. & Tyler, M. J. (1979) Reptiles and amphibians. *In* Tyler, M. J., Twidale, C. R. & Ling, J. K., eds "Natural History of Kangaroo Island". Royal Society of South Australia Inc., Adelaide.

Rawlinson, P. A. (1974) Biogeography and ecology of the reptiles of Tasmania and the Bass Strait area. *In* Williams, W. D., ed. "Biogeography and ecology in Tasmania". Junk, The Hague.

Smith, M. J. (1975) The vertebrae of four Australian elapid snakes. *Trans. R. Soc. S. Aust.* **99**, 71-84.

Smith, M. J. (1976) Small fossil vertebrates from Victoria Cave, Naracoorte, South Australia. IV. Reptiles. *Ibid.* **100**, 39-51.

Smith, M. J. (1977) Remains of small mammals including *Notomys longicaudatus* (Gould) (Rodentia: Muridae) in owl pellets from the Flinders Ranges, S.A. *Aust. J. Wildl. Res.* **4**, 159-170.

Wakefield, N. (1960) Recent mammal bones in the Buchan district. *Vict. Nat.* **77**, 164-178.